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PCT

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY
(PCT Rule 43*bis*.1)

Date of mailing
(day/month/year) see form PCT/ISA/210 (second sheet)

Applicant's or agent's file reference
see form PCT/ISA/220

FOR FURTHER ACTION
See paragraph 2 below

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/GB2005/050035	15.03.2005	15.03.2004

International Patent Classification (IPC) or both national classification and IPC
G01N21/55

Applicant
EVANESCO LTD

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will usually be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA"). However, this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notifed the International Bureau under Rule 66.1*bis*(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of three months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

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WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/GB2005/050035

Box No. I Basis of the opinion

1. With regard to the **language**, this opinion has been established on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

   ☐ This opinion has been established on the basis of a translation from the original language into the following language , which is the language of a translation furnished for the purposes of international search (under Rules 12.3 and 23.1(b)).

2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:

   a. type of material:

   ☐ a sequence listing

   ☐ table(s) related to the sequence listing

   b. format of material:

   ☐ in written format

   ☐ in computer readable form

   c. time of filing/furnishing:

   ☐ contained in the international application as filed.

   ☐ filed together with the international application in computer readable form.

   ☐ furnished subsequently to this Authority for the purposes of search.

3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

4. Additional comments:

Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	10, 29, 37
	No:	Claims	1-9, 11-28, 30-36, 38-40
Inventive step (IS)	Yes:	Claims	
	No:	Claims	1-40
Industrial applicability (IA)	Yes:	Claims	1-40
	No:	Claims	

2. Citations and explanations

see separate sheet

RE SECTION V

1. The present application relates to monitoring of fluids based on evanescent wave techniques - with particular reference to cavity ring down spectroscopy although not all embodiments rely on multiple passes within a cavity.

   The following documents are referred to:

   D1=US5239176; D2=EP0417700; D3=EP1195582;
   D4=US2002122179; D5=US4945245; D6=JP5172732;
   D7=GB2212261; D8=GB2171796.

2. CLARITY AND INTERPRETATION OF CLAIMS

   - "for use with ATIR". This wording is if at all only marginally limiting..

Doesn't need to be.

   - The fluid itself is not comprised in the claims directed to apparatus for measuring such fluid.

3. Although claims 1, 11, 12, 13, 27, 35, 38, 39, 40 have been drafted as separate independent claims, they appear to relate effectively to the same subject-matter and to differ from each other only with regard to the definition of the subject-matter for which protection is sought or in respect of the terminology used for the features of that subject-matter. The aforementioned claims therefore lack conciseness and as such do not meet the requirements of Article 6 PCT.

4. PRIOR ART

   D1 (Figs. 1-4) discloses an optical fibre as a multiple internal reflection (MIR) sensor for fluids comprising an optical fibre 10, having a tapered portion of reduced cross-section 12, cladding layer 14, sensor portion 20 mounted in a polypropylene

analysis cell 40. The use of the sensor is demonstrated for acetone in water by means of a scan spectrum which was evaluated by processor 66. in the embodiment of Fig. 4 the arrangement includes a reflector 92.

D2 (Figs. 1-2, 6) discloses a measuring device referred to as a "probe" comprising a cylindrical portion 1 of a small diameter D1 flanked by two conical portions 2 which is mounted in a casing 8 having two sealable openings 9 for the introduction of a sample medium. The probe 10 is held within two annular bodies 11 and is used to generate an IR spectrum when used in a system further comprising a light source 30, a splitting mirror 31, a sample probe 32, a reference probe 33 and detectors 34 and 35.

D3 (Figs. 1-10) discloses an evanescent wave cavity based optical sensor which is used for monitoring a chemical agent that changes its optical properties and in particular its absorption depending on the physical parameter such as pH which is to be measured - the chemically sensitive material being coated to surface section 12 of the fibre in a region where the cladding has been removed. The sensor may also be used in biomedical applications (e.g. in vivo in an animal or human body) for determining blood or tissue oxygenation, pH, haemoglobin etc. An indicator material which is required (e.g. in case of a pH measurement) is exposed directly on the fibre surface, e.g. in the form of a coating. D3 also suggests detection of protein whose binding to the sensing surface causes a change in the refractive index of the reagent coating and thus the loss of the cavity which is dependent on its concentration.

D4 (Figs. 2-3) discloses a chemical sensing system and method comprising a chemically selective surface with molecular recognition (MR) sites on gold nanoparticles, indicated at 22. The fused-silica or sapphire resonator has ultra-smooth TIR surfaces, indicated by fused silica surface 20 terminated with surface hydroxl (-OH) groups, as shown in FIG. 2(a). The nanoparticles are attached to the resonator surface 20 through reaction with the surface hydroxyls and the gold nanoparticles are, in turn, functionalised with a chemically selective MR site e.g. with molecular "cavitands" 24 which selectively interact with perchloroeythylene (PCE) molecules 26. The sensing element 30 in Fig. 3 is a folded resonator as described in US5986768, defines a cavity 32 between opposed coated planar highly reflective

surfaces 30a and 30b between which is located a sensing convex surface. Pulses from a laser source 33 incident on the resonator 30 are multiply reflected at the sensing surface before being detected by detector 35. The nanospheres 36 are located in the evanescent field and by functionalising them are able to respond to specific analytes such as NO2.

D5 (Figs. 4-5) discloses a sensor for measurement of optical characteristics of a liquid (biological culture) using a dipstick 40 and which comprises a metal housing 41 surrounding an optic fibre 44 through which an evanescent wave of light is used to excite the fluorescence of the solution which is subsequently detected by system 1323.

D6 (Fig. 1) discloses an apparatus for detecting particles in a liquid which comprises a flow cell 3 in which sample liquid flows and on which light is incident which it made to reflect totally in the flow cell - light scattered by the fine particles in the sample liquid is collected by a collection lens 6 and then to detector 13.

D7 (Fig. 1) discloses a measurement arrangement including a cell 11 through which contaminated water flows. Light from a source 14 is provided to the cell via optical fibre 15 and detected at different discrete wavelengths using filters 16, 17 connected to respective output fibres 18, 19 by detector 22.

5. NOVELTY

In view of the interpretation of claims and the disclosure of the prior art above:

Claims 1-6, 8, 13-17, 19-25, 27-28, 30-32, 34, 36, 38-40. See D1;

Claims 1-4, 8-9, 13-14, 16-17, 19-25, 27-28, 30-32, 34, 36, 38-40. See D2;

Claims 1-7, 12-17, 19-25, 27-28, 30-34, 36, 38-40. See D3;

Claims 13-15, 19-21, 24-28, 31-32, 34, 38. See D4;

Claims 11, 18. Dipstick sensor module. See D5;

Claim 35. Determining degree of degradation of the fluid from measured particle scattering. See D6, D7;

- together claims 1-9, 11-28, 30-36, 38-40 do not meet the requirement of novelty (Art. 33.2 PCT).

6. INVENTIVE STEP

The following features not disclosed in combination in the above documents are considered to be evident to the skilled person as indicated:

Claim 10. Housing is fabricated from ceramic. D2 states that the housing (casing) may be made of any suitable material. The skilled person would be aware that the main criteria are mechanical and chemical stability and would most likely consider ceramics one of the most suitable choices.

Claim 29. Fluid is lubricant (oil). The selection of lubricants as the fluid to be sensed would be one of the most likely implementations the skilled person would consider see e.g. D8.

Claim 37. From the cited prior art above, it is apparent that the skilled person is aware that measured signal is sensitively dependent on temperature and also that it is common to perform measurement at several wavelengths. Faced with the problem of accounting for systematic error due to temperature drift the skilled person would consider using two distinguishable measurements which were both essentially equally affected by temperature, the most appropriate method of distinction being wavelength.

The subject-matter of claims 10, 29, 37 therefore does not meet the requirement of inventive step (Art. 33. PCT).